DOCUMENT RESUME

ED 127 929 IR 003 891

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TITLE A Plan for the Evaluation of a Project to Develop Basic Medical Sciences Lessons on PLATO IV.
SPONS AGENCY National Institutes of Health (DHEW), Bethesda, Md. Bureau of Health Manpower Education.
PUB DATE Aug 76
CONTRACT NIH-BHME-N01-PE-34068
NOTE 7p.; Paper presented at the Association for the Development of Computer-Based Instructional Systems Summer Conference (Minneapolis, Minnesota, August 10-12, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Educational Research; Evaluation; *Evaluation Methods; *Experimental Programs; Higher Education; Instructional Materials; Instructional Technology; *Medical Education; *Program Evaluation; Project Applications; Statistical Analysis
IDENTIFIERS ADCIS 76; PLATO IV; Programmed Logic for Automatic Teaching Operations

ABSTRACT

A project to introduce PLATO IV computer-assisted instruction (CAI) in medical sciences education for health professionals was implemented at the School of Basic Medical Sciences at the University of Illinois. This paper describes the plan for evaluation of the project. Using a student questionnaire and additional general questions, the effectiveness of courseware materials will be assessed. Usage will be determined by the total hours spent with instructional materials and the number of sessions on the computer. Correlations will be calculated using test scores and hours of use on the appropriate lessons. If the number of total hours or total sessions separates students into two or more groups, analysis of variance will be conducted on the scores. The evaluation is intended to provide information for decision making and information for project personnel. (CH)

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ED127929

A Plan for the Evaluation of a Project to Develop Basic Medical Sciences Lessons on PLATO IV

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Introduction

For three years a federally funded PLATO IV Computer-based Medical Education Project* has been operational. Briefly, the purpose of this Project is to implement a PLATO IV computer-assisted instructional system that covers a major segment of basic medical sciences education for health professionals. The Project is adapted directly from the successful basic medical science program at the School of Basic Medical Sciences at Urbana-Champaign (SBMS-UC), College of Medicine, University of Illinois. The goal of the Project is to present the content in small modules complete with educational objectives and assessment procedures by which students can judge their grasp of the material. This approach allows self-paced learning and provides immediate feedback to the student about performances within the module. The Project has been described previously (Hody, 1975; Hody et al., 1975). This paper describes the plan for evaluating the Project.

Purposes of the Evaluation--A General Statement

One purpose of this evaluation is to examine the progress of the Computer-based Education Project toward goals articulated in documentation describing its inception. This requires examining the Project's attainments and assessing the impact of the Project's activities. Another purpose is to provide organized evaluated feedback to individuals considering participating in this or a similar endeavor, to the community of medical educators, and to the agency supporting the Project's work. The main focus, however, is to provide to the funding agency information for decision-making.

In addition, we hope to highlight for Project personnel those aspects of the Project for which attainments fall short, as well as those for which goals have been met. It is hoped that evaluative information from this report will facilitate planning future activities by indicating where progress is discrepant from goals and where objectives have been achieved.

Theoretical Underpinnings

The conduct of an evaluation is a complex task in that there are many purposes for providing evaluative feedback, many audiences--with varying needs--interested in the data, many facets of the entity being evaluated and diverse limitations placed on the evaluators in terms of time, resources, and support. An evaluation and subsequent report cannot address all audiences, meet the needs of all individuals, and focus on every aspect of the entity being evaluated. Because of this, it is desirable to provide a framework for the present evaluation activities. This can be accomplished by describing briefly the foundations upon which this plan is built. In doing so, the perspectives of the evaluators will become clear and will provide reasonable expectations for what follows.

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*The efforts of the Project and portions of its evaluation are pursuant to Contract No. NO1-PE-34068 with National Institutes of Health, Bureau of Health Manpower Education.

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Information for Decision-Making. Self-paced learning, self-assessment, computerized learning modules, and instructional management all have implications for changing the role of instruction in medical education. One of the potential long-term contributions of the Project lies in providing an examination of these factors. For example, educators require information upon which to assess the contribution of the Project's activities to medical education. Further, since the adaptation of a first year basic science curriculum to the PLATO IV system has required considerable financial support and demanded extensive human commitment, individuals contemplating joining the network of schools developing medical materials will ask questions about costs, requirements in terms of personnel, and hardware and software needed to support developmental activities. Answers to these questions will then be weighed against potential contributions to arrive at a decision about participating.

The basic frameworks to be used for providing evaluative information for decision-making are the CIPP (Stufflebeam, 1971) and the Discrepancy Evaluation (Provus, 1972) models, with emphasis on the product evaluation aspect of the CIPP model and on Stage IV of the Provus model.

Information for Project Personnel. The kind of description needed by Project members is one which portrays the nature of the Project and its full range of activities. Such a representation makes it easier to identify where functioning has surpassed and fallen short of original expectations, to offer suggestions for improvement, and to identify unanticipated phenomena. These purposes are difficult to accomplish if the activities are evaluated without consideration of the context in which they occur. The goal of this aspect of the evaluation is to assist Project personnel in identifying areas requiring attention. The primary techniques to be used for this aspect of the evaluation are those of responsive evaluation and portrayal (Stake, 1972,1974).

Collection of Evaluative Information

The evaluation is organized around the objectives of the Project as they were specified in the contract. These objectives were listed and then restated in terms of evaluation questions. For each question, data sources and collection procedures were identified and analyses outlined.

Student Questionnaire. The attainment of a number of objectives can be measured (at least, in part) by finding out how the students for whom the lessons were designed used and reacted to the lessons. Therefore in early May, a questionnaire soliciting opinions over many aspects of the PLATO lessons and their usefulness was sent to the 98 students in the SBMS-UC program. Based on the responses of 81 students, the preliminary results show that the students felt that they had used the PLATO lessons about as often as other types of media such as films, slide-tapes, videotapes, etc., or an average of twice a month. (Actual usage statistics remain to be analyzed.)

The students were also given the opportunity to rate each of the 29 subdiscipline lesson groupings in the catalog on a scale of "very helpful" to "not at all helpful" (with an option for "never used"). In every grouping except one, there were more students responding on the positive half of the scale than on the negative half. The lessons in four biochemistry subdisciplines (proteins, carbohydrates, acid-base, and glycolysis and TCA cycle) were rated very high,

with 36 to 39 respondents judging them to be helpful, and only two to four respondents judging them not to be helpful. Other groupings which were rated strong as being helpful were the biochemistry lessons on kinetics and cofactors, the pharmacology lessons on the autonomic and central nervous systems, and the lessons in genetics.

The students were also asked to react to a number of statements about the PLATO lessons on a scale from "strongly agree" to "strongly disagree". Summarizing briefly the areas where pronounced opinions were expressed, it was noted that the students definitely felt that PLATO was a useful learning tool and that the lessons were good supplements to the SBMS-UC curriculum document. They also agreed that the lessons supported a self-paced learning philosophy. While students were somewhat divided over whether the lessons were too elementary, there was definite feeling that the lessons were not too difficult. The students felt that they would have used the PLATO system more had a larger number of concepts been covered. The students disagreed with a statement that they had used the lessons primarily to review for internal examinations, which suggests that the lessons were utilized for basic learning. Receiving immediate feedback to answers in PLATO lessons was definitely perceived by the students as being useful.

Additional Questions and Other Data Sources. A number of other sources of information was suggested during the process of extracting evaluation questions from the contract objectives. Priorities were assigned to each data-gathering procedure based on the importance of the question being asked and how faithful the data sources were likely to be. Some of the higher priority questions and data sources follow.

1. To what extent do the developed lessons correspond to units within the SBMS-UC curriculum? For what proportion of the curriculum units would PLATO IV be an appropriate medium? How unified and comprehensive is the total set of lessons?

   An index relating developed lessons to the units of the SBMS-UC curriculum will provide the evaluators a basis for making a rough estimate of the portion of the curriculum being addressed by PLATO lessons. Additionally, Project authors (primarily responsible for the PLATO lessons) and SBMS-UC teaching faculty (primarily responsible for the curriculum and associated instructional activities) were asked to estimate the fraction of the concepts in their discipline's curriculum which were covered by PLATO lessons. Both groups were also asked to estimate the fraction of their discipline's content for which PLATO IV was an inappropriate medium.

2. How have defined student needs, content, specialist resources, and functional capabilities of PLATO IV guided lesson development? How do the courseware materials respond to identified deficiencies of educationally disadvantaged students?

   Proposals for the development of each lesson contain justification for the content and methodology to be used in the lesson. These proposals will provide a data base for the evaluators to determine the primary goals and concerns of the developers as they began each lesson. The Project author interviews queried the area of procedures and criteria for lesson development and review in order to shed additional light on these questions.

Finally, the use of the PLATO lessons made by those students which are identified as educationally disadvantaged (admitted in the U. of I. College of Medicine's Minority Opportunity Program) will be studied separately and compared with the usage for the entire basic sciences class.

3. What evidence is there that courseware materials have been or could be used in clinical training, research, and graduate training programs in health professions education?

   Directors of various health professions education programs in Illinois are being interviewed to obtain their opinions of the lessons and whether they might be useful in their programs. Those who have been responsible for remote site installations on the medical PLATO network are being asked to relate the types of people making use of the lessons and their purposes for using them.

4. What has been done to encourage continuous updating of the PLATO lessons?

   The lesson development and review procedures, as described in documentations and by Project authors and directors in the course of interviews, will be examined by the evaluators to itemize these aspects which encourage continuous updating.

Effectiveness of Courseware Materials

An original intention described in the contract was that effectiveness would be assessed by comparing the achievement of basic medical sciences students in the PLATO-supported program at SBMS-UC with that of students in the more traditional program at the Medical Center of the University of Illinois (SBMS-MC). However, the College of Medicine made the PLATO IV system (including the Project-developed courseware materials) available to students enrolled in SBMS-MC. Obviously, this decision created a situation in which it is not possible to assess effectiveness by means of program-vs-program comparisons.

In order to assess effectiveness of the materials, usage of lessons will be considered as an independent variable. Usage will be operationalized in two ways: (1) total hours a student has spent in instructional materials and (2) the number of sessions (times) on the computer. At any given point in time, it will be possible to derive these indices for every student. These data can be obtained for any lesson or group of lessons. The following strategies have been developed to analyze usage data and student performance, utilizing partial correlation and analysis of covariance:

I. SBMS-UC Usage—Performance on SBMS-UC Examinations (Level IIIs)

   Each lesson has been indexed to the applicable basic science unit(s) of the SBMS-UC curriculum. Each unit of the curriculum is assigned in one or more "clinical problems," which are the major instructional/learning segments of the SBMS-UC program. Following each clinical problem, each student takes an objective examination (Level III) over the units assigned in that problem. Subscores for each basic science discipline are reported with the results of these examinations. Therefore it is possible to associate each lesson with one or more Level III subscores. As each student

(N = 100) finishes each of the clinical problems, his/her usage data for the applicable lessons will be totaled.

Partial correlations will be calculated, correlating each subscore with the total hours of use of the applicable lessons. The "discriminant function" (DF) of each student (a function of MCAT scores and GPA, which is used in the College admission process) will be partialled out in each correlation to determine the relationship of use to Level III examination performance.

If total hours or total number of sessions separates students naturally into two or more groups (e.g., non-users, light users, heavy users) a one-way analysis of covariance will also be conducted. The Level III subscore will be the dependent variable, "usage group" the independent variable, and DF the covariate.

II. SBMS-MC and SBMS-UC Usage—Performance on College Freshman Comprehensive

The Project lessons have been indexed to sections of the College Freshman Comprehensive examination. At the end of the year, the usage data for each group of lessons associated with a particular Comprehensive subscore will be totaled for each student (N = 350, approx. 250 at SBMS-MC and 100 at SBMS-UC).

In a design similar to that of Section I (and with the same effectiveness criteria), partial correlations will be calculated, correlating each topic subscore with the total hours of use of the applicable lessons. The DF (see description in Section I) and an educational program variable (SBMS-MC or SBMS-UC) will be partialled out in each correlation.

If total hours or total number of sessions separates students naturally into two or more groups (as suggested in Section I), a two-way analysis of covariance will be conducted. The topic subscore will be the dependent variable. The independent variables will be the "usage" grouping and the basic sciences program in which the students are enrolled. The DF will be used as a covariate.

Data and Preliminary Results

Preliminary results of the evaluation will be presented at the meeting.

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